

PRICKLY PEAR CREEK 2017 REWATERING PROJECT FINAL REPORT



Picture: Prickly Pear Creek Water Users Diversion, East Helena.

December 22, 2017

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1. Introduction

1.0 Executive Summary

Prickly Pear Creek is a perennial stream that flows from its headwaters in the Elkhorn Mountains of SW Montana to Lake Helena, north of the city of Helena, Montana (Figure 1). Upon entering the Helena Valley near East Helena, the waters of Prickly Pear Creek have historically been used for irrigating lands in the Helena Valley. Because of this condition, Prickly Pear Creek suffered from chronic dewatering, and segments of Prickly Pear Creek in the Helena Valley were typically dry for much of the summer months, limiting agricultural use, fisheries support, and recreational opportunities. In 2008, the Prickly Pear Rewatering Project (PPRP) was initiated to alleviate these historic and ongoing impacts.

The Prickly Pear Rewatering Project is a joint effort between the Lewis & Clark County Water Quality Protection District (WQPD), the Helena Valley Irrigation District (HVID), Prickly Pear Creek water users (PPWU), US Bureau of Reclamation (BOR) and annual funders, with the objective of meeting irrigation demands while maintaining summer streamflow in Prickly Pear Creek. During low summer flow conditions on Prickly Pear Creek, the PPRP agreement directs Prickly Pear Creek Water Users to use water supplied by the BOR from Canyon Ferry Reservoir, delivered through the HVID canal and ditch system, rather than diverting in-stream flows from Prickly Pear Creek at the PPWU's diversion upstream from monitoring station P-4. The result of this agreement is that Prickly Pear Creek has maintained baseflow throughout the summer months, and all PPWU have receive their full allotment of water, even during drought years.

2017 marks the 10th consecutive season of the PPRP, in which PPWU have agreed to receive irrigation water from HVID instead of relying upon their late season Prickly Pear Creek water rights for irrigation demands. The project 'flow trigger' of less than 40 cfs at monitoring station P-4 was reached during the last week in June 2017, and the PPWU's ditch was shut down on Monday, June 26th. Despite having less than 0.2 inches of precipitation during the months of July and August of 2017, Prickly Pear Creek maintained flow throughout the project area the entire summer, reaching a low flow of 1.7 cfs at Station P-5 in late August. On September 14th and 15th of 2017, the area received its first significant precipitation event since June of that year. Streamflows in Prickly Pear Creek rebounded from this rain and snow event and maintained higher sustained flows throughout the remainder of the fall season.

Project benefits include both improvements in water availability to water users as well as enhancements of in-stream flows in support of habitat, fisheries and associated aquatic life. Due to the success of the Project over the past ten years, stream restoration projects on Prickly Pear Creek that improve stream and riparian habitat have become viable, and great potential exists to further improve the riparian corridor of Prickly Pear Creek and provide long-term benefits for irrigators, recreationist and overall stream health.

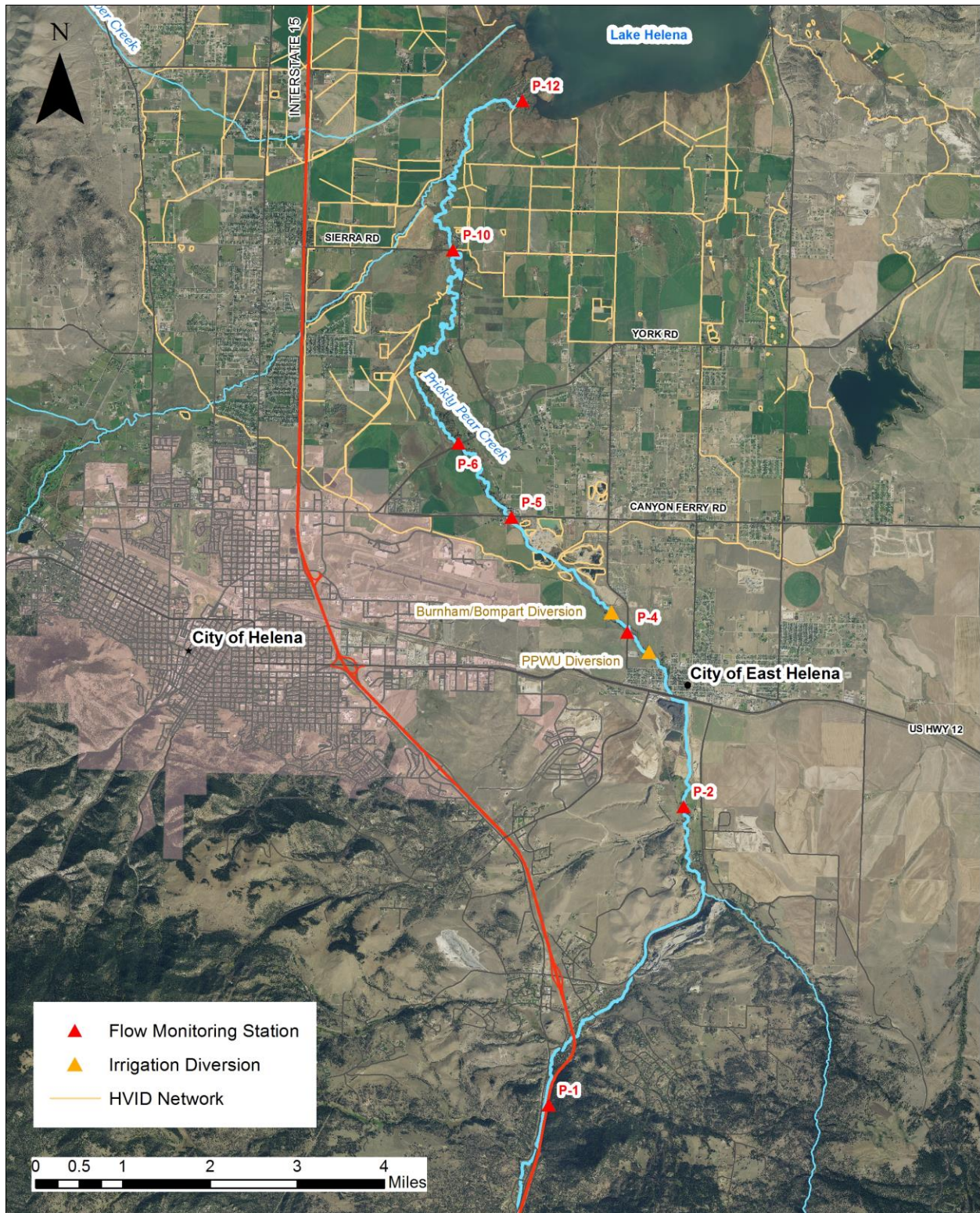


Figure 1: Prickly Pear Rewatering Project Area

1.1 Project Background

The Prickly Pear Creek Rewatering Project was initiated in 2008 and was coordinated by the Montana Water Trust for the first three years (2008-2010), before being adopted by the Clark Fork Coalition during the 2011 season. Subsequently, Farm-Stream Solutions managed project coordination with financial backing from the Bonneville Environmental Foundation and the Coca-Cola Corporation.

In 2013, Farm-Stream Solutions reached out to the WQPD, to bring in more local involvement and assistance with project management for the projects immediate and long-term future. Since 2014 the WQPD has procured necessary funds and managed the contracting and project coordination activities between the HVID, PPWU and the BOR. Additionally, the WQPD manages and conducts all necessary fieldwork and flow monitoring in support of the project.

1.2 Project Objectives and Structure

The Prickly Pear Rewatering Project (PPRP) is a joint effort between the Lewis & Clark County Water Quality Protection District, the Helena Valley Irrigation District (HVID), Prickly Pear Creek water users (PPWU), US Bureau of Reclamation (BOR) and annual funders, with the objective of meeting irrigation demands while maintaining summer streamflow in Prickly Pear Creek. During low summer flow conditions on Prickly Pear Creek, rather than diverting in-stream flows from Prickly Pear Creek for agricultural use, the PPRP agreement directs PPWU to use water supplied by the BOR from Canyon Ferry Reservoir and delivered through the HVID canal and ditch system. The result of this agreement is that Prickly Pear Creek has maintained baseflow throughout the summer months, and all PPWU receive their full allotment of water, even during drought years. Prior to the initiation of the PPRP in 2008, Prickly Pear Creek routinely went dry as a result of water diversions, and junior water rights holders typically did not receive any late-season water from Prickly Pear Creek. Since the inception of the project in 2008, Prickly Pear Creek has maintained streamflow every year throughout the summer months, and water rights users on Prickly Pear Creek have had access to their full water right.

In addition to maintaining streamflow and supporting water rights holders, the PPRP also provides benefits for instream aquatic habitat, fisheries connectivity, and recreational uses. Because of the success of the PPRP in restoring summer baseflow, the Lewis & Clark Water Quality Protection District has actively pursued restoration of several impacted stream segments and has partnered with the Montana Department of Fish Wildlife and Parks and landowners on Prickly Pear Creek to increase fish habitat and recreational access on Prickly Pear Creek.

2017 marks the 10th consecutive season of the PPRP, in which PPWU have agreed to receive irrigation water from HVID instead of relying upon their late season Prickly Pear Creek water rights for irrigation demands. The Rewatering Project agreement is set to initiate when streamflow falls below 40 cubic feet per second (cfs) at monitoring station P-4 (downstream from the PPWU Diversion) and/or when streamflow in the creek drops to 20 cfs or below at monitoring station P-5, whichever occurs first.

In order to track and quantify benefits of the Project, stream discharge measurements are taken weekly by the WQPD throughout the summer irrigation season at numerous locations along

Prickly Pear Creek. At each flow monitoring station, TruTrack continual stage monitoring instruments are installed to record stream stage throughout the summer. Instrumentation was installed in early June (after spring runoff flows) and removed in mid-November. Manual discharge measurements at the P-2, P-4, P-5 and P-6 monitoring stations are conducted throughout the summer in order to calibrate the TruTracks and allow establishment of a stage-discharge relationship and rating curve at each monitoring station. In addition to the monitoring stations established to track effectiveness of the PPRP, the WQPD also collects flow and water quality data at several other monitoring stations along Prickly Pear Creek and its tributaries. Data presented here was provided by the WQPD and processed by local consultant Ron Shields (Water Legend Hydrology), a retired hydrologist from the United States Geological Survey (USGS).

2. Field Monitoring Results

During 2017, the Prickly Pear Creek Watershed experienced below average precipitation during the spring and summer seasons (Figure 2). The project flow trigger of 40 cfs at monitoring station P-4 was reached during the last week in June 2017, and the PPWU's ditch upstream of station P-4 was shut down on Monday, June 26th. Despite having little to no precipitation during the months of July and August of 2017, Prickly Pear Creek maintained flow throughout the project area the entire summer, reaching a low flow of less than 2 cfs at station P-5 in late August.

A significant storm event that produced widespread snow and rain across the region occurred on September 14th and 15th; over 1.7 inches of precipitation was recorded at the Helena Regional Airport. This event dramatically influenced streamflows on Prickly Pear Creek as flows at station P-4 increased by over 20 cfs within a single day. Increased flows were maintained throughout the remainder of the season at all stations as cool weather and mountain snow continued to support higher flow conditions. Below is a discussion of specific flow conditions and influencing factors at monitoring stations P-1, P-2, P-4, P-5 and P-6.

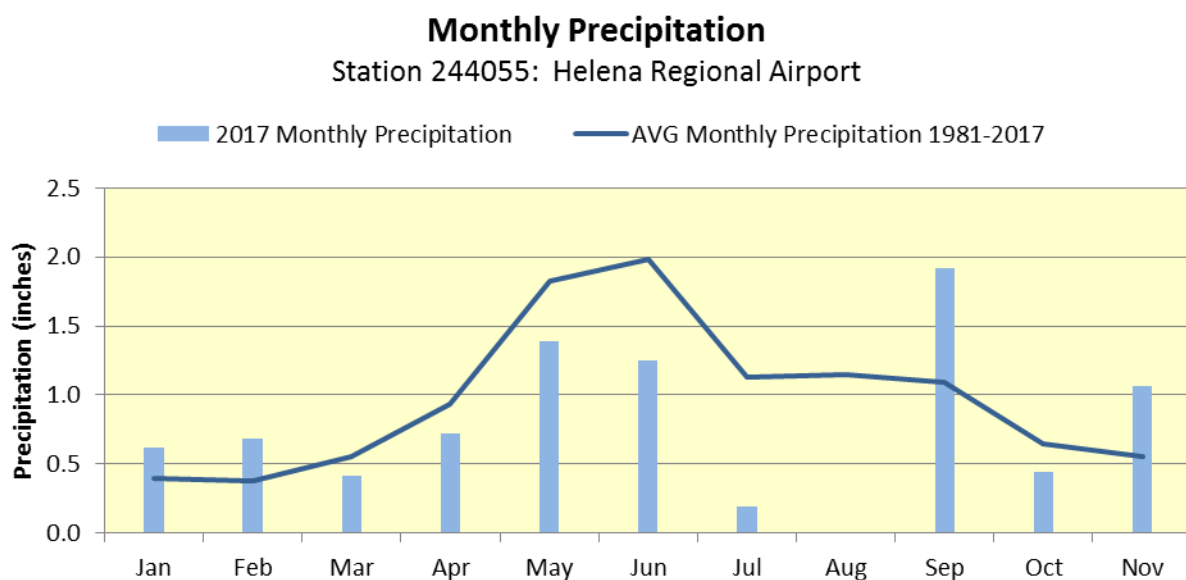


Figure 2: 2017 Helena Monthly Precipitation

2.1 Monitoring Stations P-1 & P-2

With precipitation conditions below average, streamflow in Prickly Pear Creek was significantly below the monthly average (1981-2016) at USGS Station 06061500 on Prickly Pear Creek, also identified as monitoring station P-1. Flow at station P-1 represents natural flow conditions several miles upstream of the project area, and are used to evaluate measured flows in comparison to long-term flow conditions observed. McClellan Creek, an ungauged tributary to Prickly Pear Creek, enters Prickly Pear Creek between Station P-1 and P-2 and was responsible for a baseflow increase of 2 to 14 cfs between P-1 and P-2 during July and August of 2017 (Figure 4). Flows recorded at station P-2 represent incoming flows to the project area, before any irrigation withdrawals. The flow increase recorded on 09/14/17 is in response to a significant precipitation event associated with a fall storm that produced widespread snow and rain over the region. Cool temperatures and additional precipitation events after 09/14/17 supported sustained higher flows for the remainder of the season.

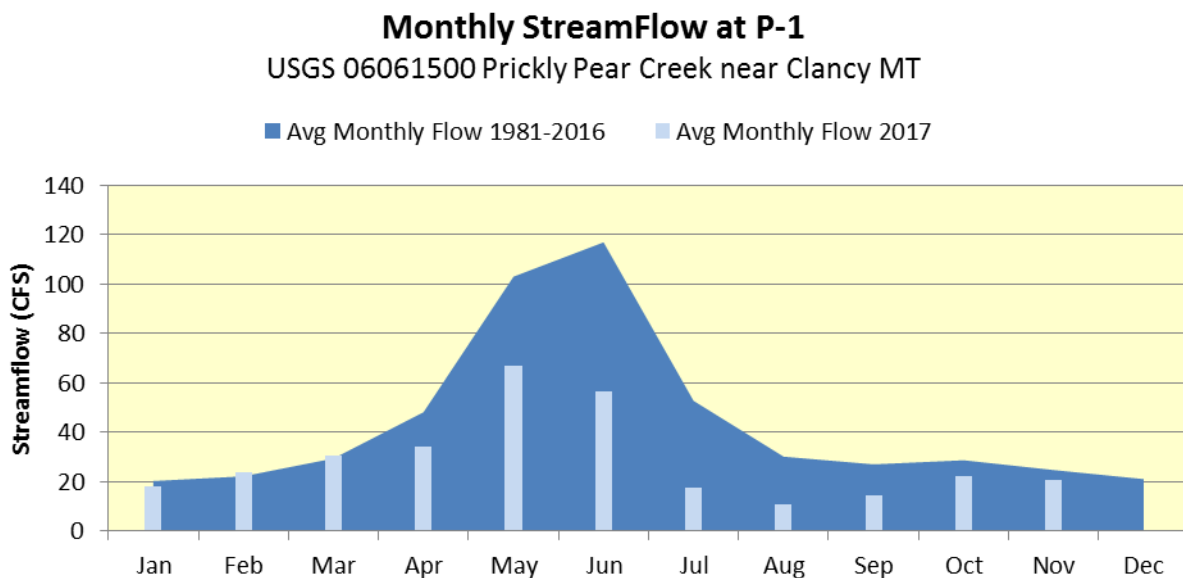


Figure 3: 2017 Average Monthly Flow at Prickly Pear Creek Station P-1

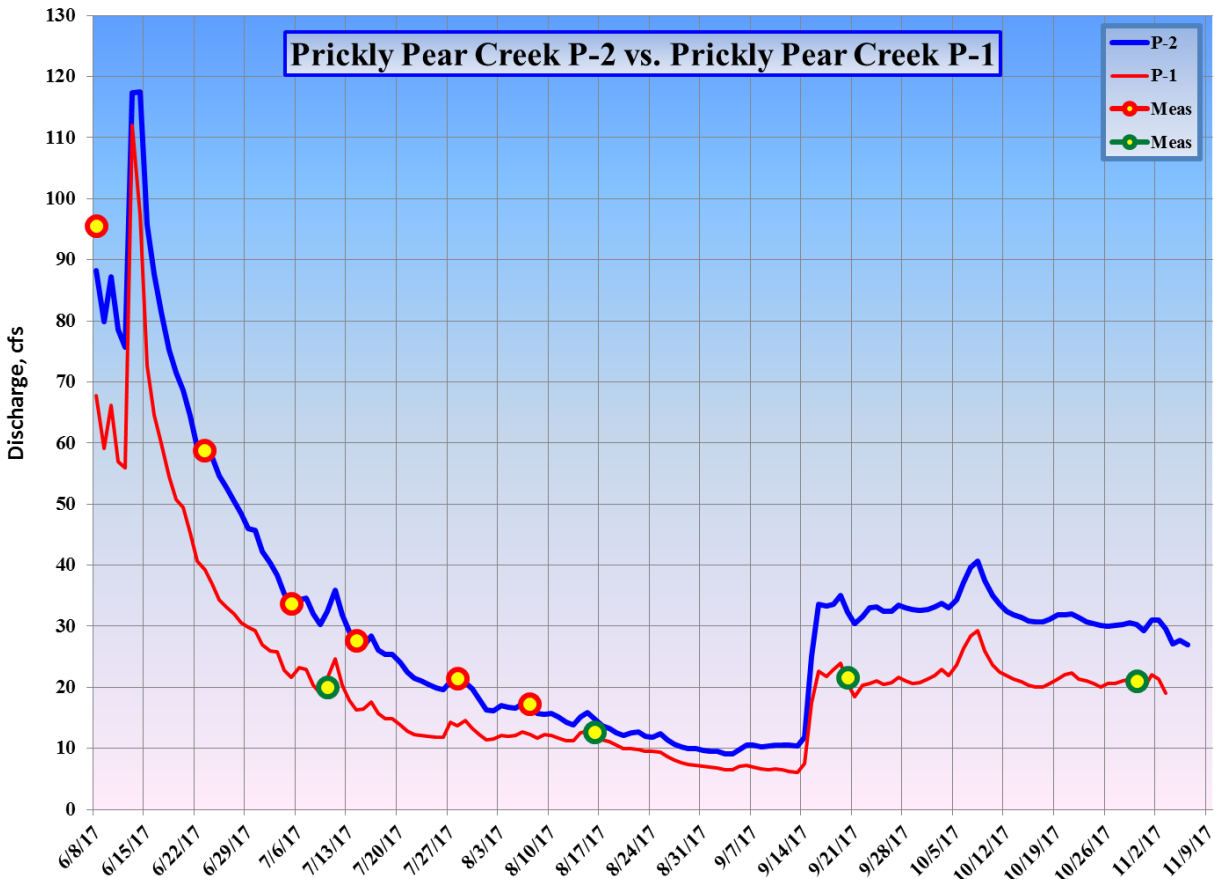


Figure 4: 2017 Flows at Prickly Pear Creek Monitoring Stations P-1 and P-2

2.2 Monitoring Station P-4

Monitoring station P-4 is located immediately downstream from the PPWU irrigation diversion and is monitored to track the immediate downstream response of Prickly Pear Creek flow from the shutting of the headgate at the PPWU diversion. Figure 5 shows the hydrograph at station P-4 in comparison to the hydrograph at upstream station P-2. The hydrographs show a flow increase of about 13 cfs on June 26th, the day the PPWU diversion upstream of P-4 was shut down for the season. After shutdown of the PPWU diversion in late June, flow differences between P-4 and upstream station P-2 remained consistent, with flows at P-2 running 2 to 3 CFS higher than at station P-4. The 2 to 3 cfs flow loss between stations P-2 and P-4 is likely due to baseflow being lost to alluvial groundwater as Prickly Pear Creek exits the upland areas and begins to flow through unconsolidated valley-fill sediments.

Despite having less than 0.2 inches of precipitation during the month of July, and no precipitation during the entire month of August, Prickly Pear Creek maintained flow at station P-4 the entire summer, reaching a low flow of 7.5 cfs on September 4th, 2017.

Flows at station P-4 increased by over 20 cfs on 09/14/2017, associated with a fall storm that produced widespread snow and rain over the region. Cool temperatures and additional

precipitation following this event supported sustained higher flows for the remainder of the season.

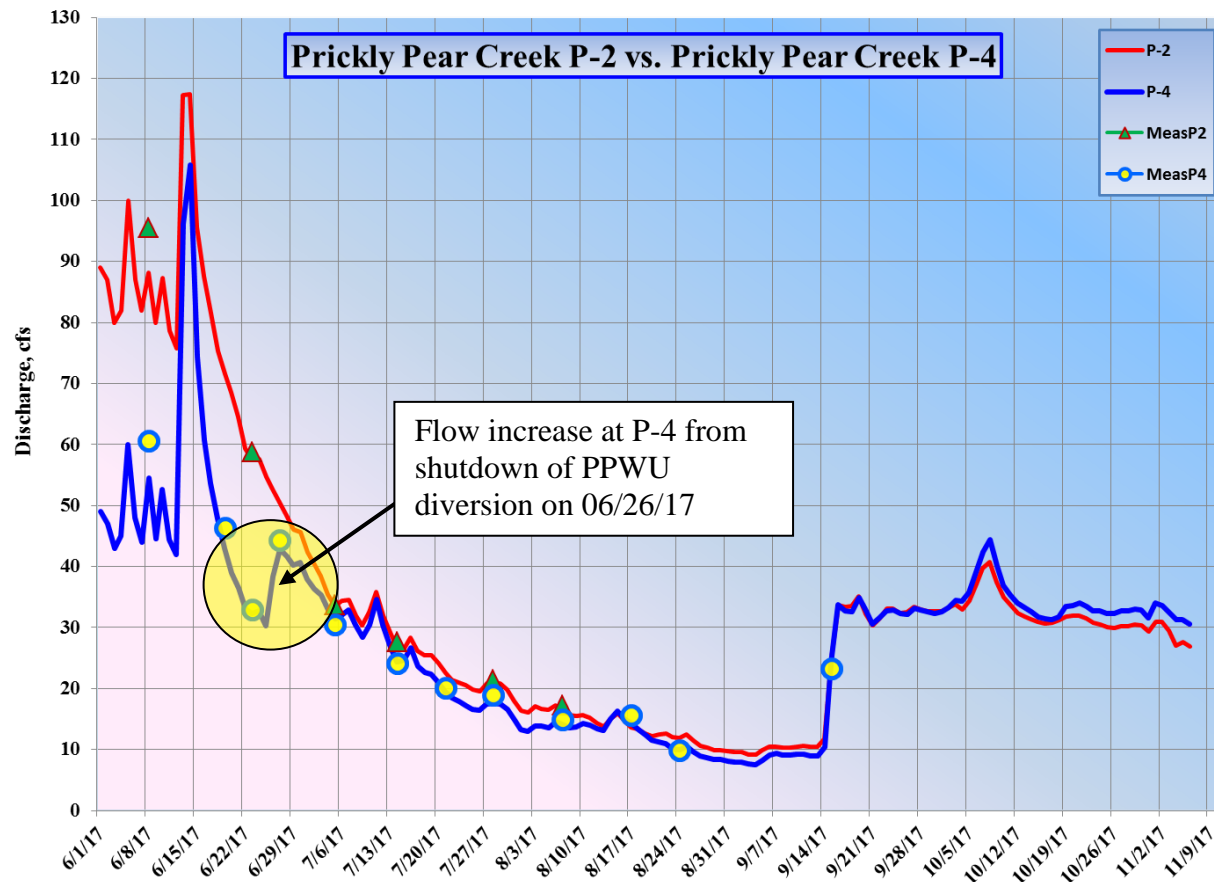


Figure 5. Flows at Prickly Pear Creek Monitoring Stations P-2 and P-4

2.3 Monitoring Station P-5

Monitoring station P-5 is located downstream from station P-4 at the crossing of Canyon Ferry Road, and is monitored to track downstream response of Prickly Pear Creek flow from the shutting of the headgate at the PPWU diversion upstream from station P-4. Streamflows at the P-5 site are typically 5 to 15 cfs lower than upstream station P-4, with smaller differences during late summer low flows.

Flow losses through this reach (Figure 8) are the result of a few factors. Irrigation diversions of up to 6 cfs occur within this reach, with the majority of the diverted flows occurring at the Bonham/Bomparte diversion about ¼ mile downstream from station P-4. It is suspected that additional streamflow losses through this reach are the result of alluvial losses and groundwater pumping associated with several deep gravel pits managed by Helena Sand and Gravel and located adjacent to the stream channel. While this supposition has not been investigated formally through targeted assessments, it does not seem unreasonable that the nearby gravel operations are at least partially responsible for the flow losses observed through this reach.

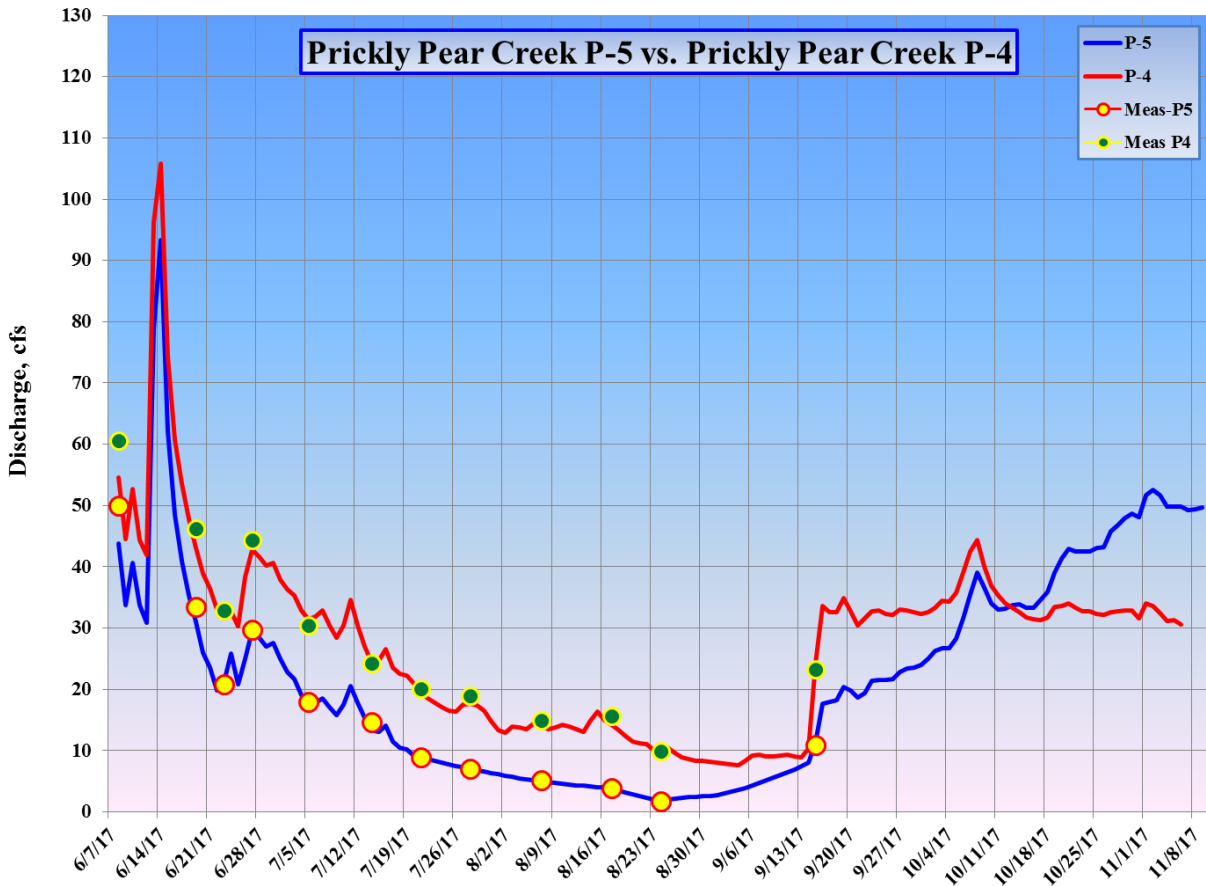


Figure 6. Flows at Prickly Pear Creek Monitoring Stations P-4 and P-5

Ten years of flow monitoring on Prickly Pear Creek has shown that station P-5 is typically the location on the creek where, annually, the lowest flows have been recorded. This held true in 2017 when a seasonal low flow of 1.7 cfs was recorded on August 24th. Prior to the establishment of the PPRP agreements, station P-5 would go dry nearly every summer. Flows at station P-5 rebounded from this August low, primarily due to a significant storm event on 09/14/2017. Cool temperatures and additional precipitation following this event supported sustained increasing flows for the remainder of the season.

2.4 Monitoring Site P-6

Monitoring station P-6 is located downstream from station P-5 at the crossing of York Rd, and is monitored to track downstream response of Prickly Pear Creek flow from the shutting of the headgate at the PPWU diversion upstream from station P-4. Streamflows at station P-5 and P-6 are typically equivalent, with less than 2 cfs difference between the two stations.

During 2017, the P-6 TruTrack malfunctioned, making late season flow records unreliable, as the TruTrack instruments recorded vast disparities in flows between the two stations after September. And while earlier season flow records at P-6 are within expected flow conditions based on P-5 observations and manual discharge measurements at both stations, P-6 data should be viewed with caution. Figure 7 shows a comparison of flow recorded at stations P-5 and P-6. Note that the P-6 flows presented in this figure were derived from processing data from a

malfunctioning device and should be viewed with the understanding that these flows may not be accurate.

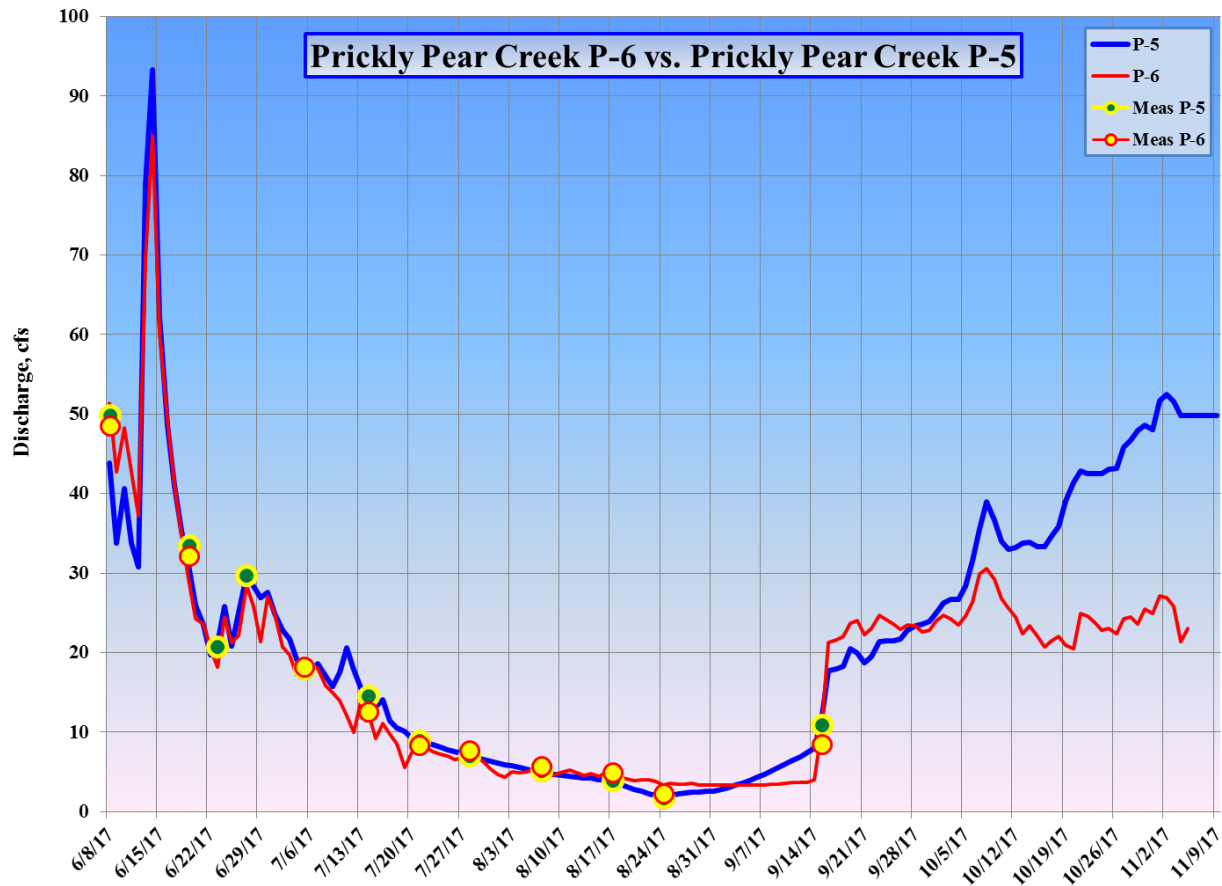


Figure 7. Flows at Prickly Pear Creek Monitoring Stations P-5 and P-6



Figure 8: Prickly Pear Creek from Station P-4 to Station P-6

3. Project Discussion

3.1 Project Benefits

From the monitoring results provided, it is clear that Prickly Pear Creek system would have gone dry without the Rewatering Project in place during the 2017 irrigation season. Data shows that the project in its current capacity is sufficient to keep the stream reach between P-4 and P-5 flowing and connected, even in extremely dry years. Severe lack of precipitation and above average temperatures during the summer of 2017 resulted in the lowest recorded flows on Prickly Pear Creek since the project inception in 2008. Despite this lack of precipitation, Prickly Pear Creek maintained its connectivity through the project reach, with the seasonal low flow of 1.7 cfs recorded at monitoring station P-5 in late August.

As observed in previous years, regular and consistent streamflow losses are observed in the reach between monitoring station P-4 and P-5, presumably due to alluvial losses from the pumping of adjacent gravel pits in this reach. If Helena Sand and Gravel's historic gravel pits and operations are affecting streamflows with continued water pumping at their pit sites as believed, problems may be alleviated in the coming years as the company does have plans to move the current operations to a new location away from the stream. Further field investigation and targeted monitoring may inform a more robust analysis of the conditions affecting flow losses in this reach.

In 2016 the WQPD and PPWU created a five-year agreement to continue the Rewatering project until 2021. Also the HVID contract was also signed to continue the arrangement to deliver water to the PPWU system for the next five years. Both agreement are conditional on the WQPD have sufficient funding to implement the project for each year.

3.2 Project Future

With another successful year behind the Prickly Pear Creek Rewatering Project, we again begin to work to secure financial support for continuing this project for years to come. Funding for 2018 is underway, with the promised support of the Bonneville Environmental Foundation, City of Helena, and Northwestern Energy.

In addition to flow monitoring, the water quality protection district collected water quality samples and conducted aquatic surveys along Prickly Pear Creek in 2017. While beyond the scope of this report, these data will assist in evaluating water quality and ecological benefits realized through the Rewatering Project. In the fall of 2017 WQPD staff met with DEQ's Water Quality Bureau to plan for formal assessments and evaluations of Prickly Pear Creek's ability to support beneficial uses, a process last conducted by the DEQ in 2000. The WQPD will continue to collect water quality data in support of this assessment effort, and expect that the flow benefits of the Rewatering Project will also show improved ecological and water quality conditions as well.

Several modifications to the monitoring program are planned for 2018. These include:

- Adding a monitoring station at the mouth of McClellan Creek to measure inflows from McClellan Creek to Prickly Pear Creek between stations P-1 and P-2.
- Assessing the flow losses from irrigation diversions between stations P-4 and P-6.

- Moving station P-6 downstream to a more stable channel condition.
- Continuing to collect high and low-flow water quality samples to evaluate water quality benefits from the PPRP.

The WQPD will continue to manage all project components moving forward and continue project effectiveness monitoring. All parties remain committed to seeing this project continue onward successfully, and with the continued support of the HVID, BOR and PPWU, there is reason for us to believe this project can find solid foundational support necessary to continue for years to come.

3.3 Acknowledgments

The 2017, Prickly Pear Creek Rewatering Project was made possible by numerous sponsors and partnerships. Primary funding and support was provided by, the Bonneville Environmental Foundation (BEF), City of Helena Public Works Department, Northwestern Energy Corp., and the Lewis and Clark County Water Quality Protection District (WQPD). See Appendix A for project expenses.

APPENDIX A

2017 Prickly Pear Creek Rewatering Project Expenses

US Bureau of Reclamation Water Purchase	\$1,720
Helena Valley Irrigation District (HVID) Water Service Contract	\$12,000
Prickly Pear Creek Water Commissioner	\$1,500
Technical Services - Water Legend Hydrology	\$500
Cash Totals	\$15,720
Lewis & Clark County In-Kind Contributions:	\$5,546
Stream monitoring equipment & services , project administration, funding solicitation, reporting, and staff time	
Total Project Cost	\$21,266